REMARKS

Drawings

The Examiner objected to the informal nature of the drawings. Formal drawings will be submitted on allowance of this application. However, permission to amend the drawings as shown in red ink in the attached copy of Figs. 6A and 6B is hereby requested. The changes are for conformity with the change made to the description referred to immediately below.

Specification

The Examiner objected to the disclosure, stating that "manifold 84" on page 13 at line 23 should be changed to "manifold 89". This change has been effected.

In view of this, a corresponding change is required to Figures 6A and 6B of the drawings, as requested immediately above.

Claim Objections

The Examiner objected that the term "though" should be changed to "through" in claims 2 and 19. This change has been made.

The Examiner also objected that one of the duplicate words "liquid" should be deleted from claims 7 and 24. This has been attended to.

Claim Rejections – 35 U.S.C. § 103

The Examiner rejected claims 1-6, 8-23 and 25-45 as being unpatentable over U.S. Patent No. 4,193,440 (Thorburn et al.) in view of U.S. Patent No. 4,061,178 (Sivilotti et al.).

The Examiner has argued that it would be obvious to combine the hexagonal nozzles of the Thorburn reference with the vacuum system of the Sivilotti reference and arrive without inventive step at the present invention. Reconsideration of this rejection is requested for the following reasons.

The Thorburn et al. reference teaches an improvement to the nozzles of the Sivilotti reference that arose from the realization that improvements would arise if the perimeter of the nozzle were changed from circular (e.g. as described in the Sivilotti et al. patent) to hexagonal to thereby achieve a "closer packing" of nozzles below the casting belt and thus maximize the supported area (minimize the unsupported area as stated in Col. 2, Lines 27 to 41 of Thorburn et al). In addition, the individual (resilient) nozzle mounts provided a further advantage. However, the nozzles of Thorburn et al. still consisted of a central circular

coolant inlet and the coolant was removed through a gap provided around the circumference of the nozzle.

Both the Thorburn et al. and the earlier Sivilotti et al. references describe a coolant systems in which the peripheral (circumferential) length of the coolant removal channel is substantially greater than the peripheral length (circumference) of the central coolant inlet opening. Coolant flow is two-dimensional, that is, entering at a central coolant inlet and flowing <u>in all directions horizontally</u> outwards to the surrounding coolant removal channels. The vacuum applied to such coolant removal channels would be effective along with the coolant flow in establishing a controllable positioning and cooling of the casting surface, with the Thorburn et al. reference providing for maximization of supported area upon individually resilient nozzle mounts.

In the present invention, an entirely different coolant inlet system is used, namely a slot extending continuously and fully across the casting surface with associated adjacent coolant removal slots to which a vacuum is applied. The coolant flow is therefore <u>one-dimensional</u> (directly upstream and downstream from the inlet slot to adjacent exit slots). The result is an unbroken coolant layer having bi-directional (but essentially one-dimensional) flow combined with a belt/support hydrodynamic relationship that is particularly effective near the entry point of the casting cavity. The cited prior art thus teaches that for nozzles that are circular or hexagonal in shape (specifically using "point sources" of coolant to create a two-dimensional flow pattern) then conditions can be found where the casting surface position with respect to the underlying support can be controlled and the surface cooled effectively. The peripheral length of the inlet <u>slot</u> in the present invention is approximately the same as, or could be even greater than, that of the coolant removal slot, creating a very different relationship between inlet opening and exit opening (with its associated vacuum system) than that described in the combination of the Thorburn et al. and Sivilotti et al. patents cited by the Examiner. That feature, in combination with a very different coolant flow pattern resulting in the present invention from that taught by both the Thorburn et al. and Sivilotti et al. references, means that a person skilled in the art would not use the teaching of the Thorburn et al. and Sivilotti et al. patents to lead to the present invention. There is no reason for such a person to conclude that such a system would operate in the same way as the combination of the prior art references and that some new optimal operating position would be found.

Both Thornburn et al. and Sivilotti et al. are concerned exclusively with point form coolant inlet. There is no disclosure whatsoever in Thorburn et al. or Sivolotti et al. of a nozzle having "a continuous slot ... arranged transversely substantially completely across the

casting belt" as required by claim 1 of the present application. There is furthermore no suggestion in the combination of Thorburn et al. and Sivilotti et al. that a modification of the design required to go from point coolant inlets with circumferential coolant removal to a continuous (slot form) coolant inlet with adjacent coolant removal would be useful to try as a means to improve on or modifying the optimal conditions established for hexagonal or circular nozzles plus vacuum system.

The specific mechanical advantages claimed in Thorburn et al. in minimizing the "unsupported" areas with individually mounted resilient nozzles, which presumably contributes to achieving optimal performance for the hexagonal configuration, are either not features specifically embodied in the present invention or are actually absent from the present invention, and therefore there would be no reason based on Thorburn et al. in combination with Sivilotti et al. to move from a hexagonal (or circular) individually supported nozzle system to the present invention.

It should also be noted that Thorburn et al. additionally teaches that the nozzle surface should be flat <u>except for a depression around the coolant inlet</u> and further suggest that earlier such nozzles also had this feature. There is nothing in either Thorburn et al. or Sivilotti et al. to suggest that a bevel (at the outer edge of the nozzle) as claimed in Claims 14, 15, 31 or 32 would have any beneficial effect as was found in the present invention.

The Examiner then went on to reject claims 7 and 24 as being unpatentable over Thorburn et al. in view of Sivilotti et al. and further in view of U.S. Patent No. 3,799,239 to Dumont-Fillon.

It is believed that the Examiner incorrectly referred to Column 2, Lines 53-67 rather than Column 5, Lines 57-67 of Dumont-Fillon. While this reference does describe a filter used in a coolant system, it is noted that the rejected claims are dependent from other claims discussed above and that the rejected claims should be considered patentable for the same reasons as the claims discussed above.

In view of the amendments and arguments made above, favourable reconsideration of this application is requested.

Respectfully,

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I hereby certify that this paper is being deposited this date with the U.S. Postal Service as first class mail addressed to Assistant Commissioner for Patents, Washington, D.C. 20231

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Date FEBRUARY 20, 2002

MARKED UP COPY OF THE REPLACED PARAGRAPH AND CLAIMS SHOWING THE AMENDMENTS

DESCRIPTION

--An alternative embodiment of the invention consisting of a single linear nozzle is shown in Figs. 6A and 6B. The nozzle support surface is of the same flat top configuration as shown in Figs. 3A and 3B, but any of the other slot and surface variations may equally be used. The nozzle 30 consists of a bottom section 80 that is held by bolts 81 to the top surface of the cooling liquid supply chamber (not fully shown) and an upper section formed by two top members 82. The two top members and the bottom section are held together by through bolts 83. The top members are machined precisely to mate with the bottom section and give the required elevation, and to provide a gap 84 between the adjacent faces of the top members which can be further adjusted by the bolts 83. Cooling liquid is fed to the nozzle from the cooling liquid supply chamber through passages in the bolts 81, or alternatively through separate supply ports, into a manifold [84] <u>89</u> formed by the bottom section 80 and the top members 82 and extending the full length of the slot 84. Cooling liquid flowing off the nozzle is removed through passages 85 similar to those at the edges of the nozzle assembly in Figs. 3A and 3B.--

CLAIMS

-- 2.(Amended) The apparatus of claim 1, wherein a first of said at least one nozzles taken in the direction of advancement of the said belt [though] <u>through</u> said casting apparatus is positioned immediately adjacent to the entrance of the casting mold.

7.(Amended) The apparatus of claim 1, including a filter for filtering particles from the cooling [liquid] liquid before said liquid passes through said slot.

19.(Amended) The twin belt caster of claim 18, wherein a first of said at least one nozzles taken in the direction of advancement of the said belt [though] <u>through</u> said casting apparatus is positioned immediately adjacent to the entrance of the casting mold.

24.(Amended) The twin belt caster of claim 18, including a filter for filtering particles from the cooling [liquid] liquid before said liquid passes through said slot. --